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TRANSLATOR'S AFFIDAVIT

I, Herbert Dubno, a citizen of the United States of America, residing in Bronx (Riverdale), New York, depose and state that:

I am familiar with the English and German languages;

I have read a copy of the German-language document attached hereto, namely PCT/DE2003/002621; and

The hereto-attached English-language text is an accurate translation of the above-identified German-language document.

Herbert Dubno

Sworn to and subscribed before me
28 January 2005

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TRANSLATION

MAIN OR PRESS CYLINDER FOR A TUBE PRESS AND AN EXTRUSION PRESS

The invention relates to a main cylinder or press cylinder [compression cylinder] of a pipe or tube press and extrusion press which is mounted in a cylinder beam [traverse] and which has a press piston in its cylinder housing connected with a rod which projects from the cylinder housing.

A tube or extrusion press configured as a frameless metal extrusion press in which the rod of the press piston is configured as a piston rod, which are located at positions normally occupied by tension rods or columns of the usual press frame and which are connected with the counterbeam, is known from DE 198 35 717 A1 with two such main press cylinders. In order to achieve a high degree of operating efficiency and to minimize dead time, both the take up of the play and the retraction should be carried out with the greatest possible speed, which requires high volumetric flow of the fluids involved. The main cylinders are thus configured with approximately the same stroke volume to both sides of the main press piston and a switchable connection is provided between the partial cylinder spaces on the two sides.

To press a blank, the press piston of the press cylinder supported by the cylinder beam is pressurized and for this purpose the piston rod of the press piston must extend to and be connected with the traveling beam. The press piston with its piston rod is bored to form a hollow over a part of the length to constitute a cylinder bore in which a plunger piston extends, the latter being braced against a cover closing the cylinder. The pressurization of the plunger piston allows retraction of the press piston and with it via the piston rod, the traveling beam into the starting position. Further piston and cylinder units are braced against a base frame of this press in order to enable the traveling beam to be displaced over the play or nonload portion of its stroke in a rapid movement.

Apart from the fact that this metal extrusion press brings with it a certain significant expense, numerous components must be mounted on the counterbeam to permit the main cylinder with its piston rod to connect to the traveling beam. This has been found to limit the working range of the metal extrusion press above all in cases in which the extrusion press profile or cross section is not straight but in which the extrusion press profile should be produced with curvatures or radii in different directions (compare EP 0 706 843 B1).

The invention thus has as its object to provide a main or press cylinder of the type described at the outset which, while

retaining a short-circuiting flow technique for rapid movement, enables in a simpler manner a rapid transfer of the pressurizing oil from one to another space, thereby simultaneously reducing the structural cost and permitting a press construction which admits of a sufficiently large free space ahead of the counterbeam that extrusion products with radii or curvatures can be produced in an unhindered manner.

These objects are achieved according to the invention in that the rod is configured with an integrated forward drive and retraction cylinder and in an axial hollow bore thereof a telescoping or sword-like tube is received with formation of a pressurizable space connected via an annular gap with the pressurizable space in a flow path. The annular space is surrounded concentrically by an elongated sleeve housing and the sword-like tube together with the sleeve housing at an end projecting from the rod is held stationary in a hydraulic connecting element which has a fluid connection or feeding opening into the telescoping tube and a connecting opening or fitting opening into the annular gap. The rod is configured according to the invention differently than with the known configuration as a forward drive and retraction cylinder so that the otherwise conventional lateral cylinders are eliminated and simultaneously a more rapid forward drive and retraction of the press cylinder is achieved. For this purpose the pressurized oil head is so controlled or reversed with the known hydraulic means that it can

give rise to a rapid advance by means of the telescoping tube and the space lying forwardly thereof in the axial hollow bore of the rod or to a rapid retraction through the pressurizable space and then through the annular gap whereby the pressurization of the press piston in these directions are correspondingly supported by these additional oil quantities.

As to the configuration of the forward advance and retraction cylinder in the rod, the invention provides that the hollow bore be sealed against the sleeve housing by a packing which rides on the housing sleeve upon pressurization and which is fixed piston-like at the end of the rod and engages into the pressurizable space. Upon pressurization of the press piston in its working stroke, this rod seal delimiting the pressurizable space rearwardly slides upon the telescoping tube which together with the sleeve housing are held stationary, into its forward end position. When the unit is switched over to retraction, the pressurized oil flowing into the pressurizable space via the annular gap is effective upon the rod seal.

According to an embodiment of the invention, the end of the telescoping tube lying in the hollow bore is configured with an enlarged head sealing the annular gap, this head fastening the telescoping tube with the sleeve housing in such manner that at this end a radial seal is formed by a collar against the inner wall of the hollow bore. This ensures that for the rapid forward

displacement of the press piston, the additional pressurized oil fed through the telescoping tube can pass into the pressurized space defined in the axial hollow bore of the rod but not however into the annular gap or the pressurized space between the housing sleeve and the rod in the case of a rapid retraction. The passage of the pressurized oil which is additionally supplied, to locations other than through the annular gap into the pressurizable space between the housing sleeve and the rod is excluded.

The sealed radial collar of the sleeve is advantageously provided for the simultaneous flow connection of the annular gap with the pressurizable space between the housing sleeve and the inner wall of the axial hollow bore of the rod in that, according to the invention, an annular gap is provided in the radial collar at the bores connected to the pressure space.

According to an advantageous construction of the invention, the cylinder chamber of the main cylinder housing is formed with a guide for the press piston and, the cylinder housing bottom is formed with a guide for the rod. As a consequence a support traverse used for the press ram can be eliminated since the ram as well as the press piston can be cantilevered toward the counterbeam of the extrusion press. As a result there is in total a two point guiding of the press piston and its rod, in one case in the region of the front of the cylinder and in the other case in

the region close to the total thickness of the cylinder housing bottom for the rod.

Thus a construction of the tube and extrusion press or metal extrusion press is contemplated in which the configuration of the forward drive and retraction cylinder extends away from the counterbeam and rearwardly of the cylinder beam and the position of the rod is such that in the working space between the cylinder beam and the counterbeam of the press there are no unnecessary components which may be detrimental and can interfere with the working range and in addition lateral cylinders as well as a traverse for the ram itself can be completely omitted.

A further feature of the invention or solution to the objects set forth, in accordance with the invention is a tube and extrusion press in which the free forwardly projecting or counterlevered end of the rod is enclosed in an equalizing or compensating vessel affixed to the main cylinder housing and in which, upon pressurization of the press cylinder has a slider which is sealed with respect to the inner wall of the container and slides on the rod end removed from the main cylinder housing, whereby space formed between the rod and the compensating vessel is closed at its end by the slider and opens from the point of view of flow at the cylinder compartment lying behind the press piston at which a pressurized oil duct opens.

It is thus advantageously provided that the compartment of the compensating vessel is connected to the tank conduit and preferably is arranged in a switchable blocking valve in the connecting line communicating with the cylinder housing bottom and which runs from that space to the cylinder space behind the press piston. In this manner, upon the advance of the press piston into its working position, the open blocking valves, four of which can be provided, configured as two-way valves built into the apparatus or also as logic controlled valves or cartridge valves, can be used to control the flow from the chamber of the compensating vessel of the supplied oil when the press piston, which has the same diameter as the compensating vessel, has reached its working position and is about to begin a press operation. The connecting lines can be closed by means of the blocking valves so that the slider displaces the remaining oil quantity in the compensating vessel only back to the tank while the associated pressurization with oil under pressure will not suck back oil so that the tank can be spaced at a goodly distance from the press and be connected thereto by the oil pressure lines. The oil lines need not, therefore, be of particularly large cross section as is the case where a compensating vessel is not provided at the end of the press stroke and upon reversal of the hydraulic control unit to initiate the retraction phase of the press piston back to its starting position in the cylinder housing, the flow flows back into the compensating cylinder, that is the oil in operation of the pipe or extrusion press is shifted back and forth under pressure.

The mode of operation with a compensating vessel is especially suitable in combination with the rod with its integrated forward drive and retraction cylinder of the aforedescribed type because then no lateral cylinder is required for the forward and rearward movement.

Further features in detail of the invention are given in the claims and the following description of the single Figure of the drawing showing a construction in which the press piston rod is surrounded by an equalizing vessel and in the rod has integrated a forward drive and retraction cylinder in accordance with an embodiment of the invention.

The extrusion press 1 shown in a plan view in section in an embodiment with a horizontal construction, has a cylinder beam 2 only one of which can be seen in the Figure and in which a cylinder housing 3 is mounted to form a main or press cylinder 4. The cylinder beam lies in the plane of the drawing and to the left thereof is juxtaposed with a tool (press plate, die holder and die) fitted onto a counterbeam which has not been shown. In the cylinder housing 3 a press piston 5 is disposed which, at its forward end in the press direction 6 is provided with a press ram 7 which, upon pressurization of the press piston 5, presses a metal block which has been loaded into the receiver through the tool or die of the counterbeam (not shown). At the other, rearward end of the press piston 5 a rod 9 is attached by screws and extends

rearwardly through the cylinder housing bottom 8 from the cylinder beam rearwardly. The unit formed by the press piston 5 and the rod 9 are guided without play in a fully determined manner, namely, in a first guide 10 for the press piston 3 and second guide 11 for the piston rod 9 in the cylinder housing bottom 8.

The rod 9 is integrated with a forward drive and retraction cylinder 12. For this purpose an axial hollow bore 13 is provided in the rod 9 and in a stationary hydraulic connection block 14, a telescoping or sword-shaped tube 15 and a housing sleeve 15 concentric therewith are mounted while defining an annular gap 16 between them. The housing sleeve 17 defines a pressure chamber 18 with an inner wall of the hollow bore 13. The ends of the housing sleeve 17 and the telescoping tube 15 which extend into the axial hollow bore 13 of the rod 9 are guided with a thickened head 20 in a radial collar 19 sealed against the inner wall of the hollow bore 13, the thickened head 20 sealing the end of the annular gap 16. At the rear free end, the pressure chamber 18 is sealed by a packing 21 which slides along the outer wall of the housing sleeve 17 during the movements of the pressing piston in its forward rearward stroke and which is connected by screws to the rod 9. To establish a flow communication between the pressure chamber 18 and the annular gap 16, bores 22 are machined in the radial collar 19 of the housing sleeve 17.

The hydraulic connecting block 14 has a pipe connection or fitting 23 opening into the telescoping tube 15 and a pipe connection or fitting 24 opening into the annular gap 16 and connected to an oil supply not shown and with a conventional hydraulic unit for the switchover of hydraulic fluid flow.

For rapid movement of the press piston 5 into this working position in the press direction 6 [to bring the ram 7 up against the blank to be forced through the die] oil flows from the oil supply through a pressurized oil duct 27 into the cylinder chamber 28 behind press piston 5 and simultaneously through the conduit 25 and the connection 23 into the telescoping tube 15 so that this additional oil quantity flows into a pressure chamber 29 lying ahead of the radial collar 19 and the thickened head 20 in the hollow bore 13 and supports the forward stroke. As soon as the press piston 5 has reached its pressing position, the oil supply through the conduit 25 to the telescoping tube 15 is blocked and the working pressure is applied only via the pressurized oil line 27 [to the chamber 28].

For the retraction or backward movement of the press piston 5 into its starting position shown in the drawing, an oil flow is directed by the hydraulic control unit out of the cylinder chamber 28 and the pressure chamber or space 29 and, simultaneously, through the conduit 26 and the connection 24 additional oil is fed to the annular gap 16 from which it is distributed by the bores 22 into the pressurizable space 18 and

effects a retraction movement of the press piston 5 by acting on the packing 21.

The embodiment shown in the drawing indicates further that the integrated forward drive and retraction cylinder and rod 9 are combined further with a compensating vessel 30 attached by screws to the cylinder housing bottom 8. The compensating vessel is closed at its rearward end by a slider 31 fixed on the rod 9 and whose outer periphery is sealed against and slides along the inner wall of the vessel during the piston strokes. The hydraulic connecting block 14 for the integrated forward drive and retraction cylinder 12 of the rod 9 is attached by screws to a bell 32 which, on its part, is attached by screws to the end of the compensating vessel 30. The space 33 which is enclosed between the compensating vessel 30 and the rod 9 and between the cylinder housing bottom 8 and the slider 13 contains oil which, from that space, flows either into the cylinder chamber 28 behind the press piston 5 through the connecting passages 35 provided ind the cylinder housing bottom 8 or is through the tank conduit 34 into a tank or in the opposite direction for pressurization in the opposite sense and thus is moved back and forth.

In the forward movement of the press piston 5 into its operating or pressing mode, the switchable blocking valves 36 of cartridge construction and arranged in the connecting passages 35 are in their open operating positions so that oil can be displaced

from the chamber 33 by the slider 31 under pressure into the cylinder or plunger chamber 28. In the press position, the blocking valves 36, of which a total of four are provided, are closed by the hydraulic control unit through the control lines 37 and the pressurizable oil for the actual extrusion is supplied only via the pressurized oil conduit 27 to the cylinder chamber 28 through the tank line 34 which remains open during this operating phase the slider 31 displaces the residual oil remaining in the space 33 into the tank as the slider 31 is moved during the press stroke in the press direction 6. The end position assumed by the slider 31 at the conclusion of the press or working stroke has been shown in a dot dash line at 31'.

In the rearward movement of the press piston 5 into the starting position shown in the drawing, by reversal of the control and flow directions, corresponding flow paths are opened so that the space 33 of the compensating vessel 30 can again be filled with the starting quantity of oil. The rapid movements for the forward and retraction stroke are then effected in the above described manner with the forward drive and retraction cylinder 12 integrated in the rod 9. For possible leakage, ahead of the slider 31 a leakage oil conduit 39 leading to a tank 38 is provided.